

Appl. No. 10/598,680
Amdt. Dated February 19, 2009
Reply to Office Action of December 9, 2008

Attorney Docket No. 81880.0151
Customer No. 26021

Amendments to the Drawings:

The attached New Sheet includes new Figures 25A and 25B.

- 1 Attachment: New Sheet (Figures 25A and 25B)

REMARKS/ARGUMENTS:

Minor changes are made to this specification and drawings. New claims 38-41 are added. Support for new claims 38 and 39 can be found in paragraphs [0051] and [0052] of Applicant's specification. Support for new claims 40 and 41 can be found in paragraphs [0016], [0169], and [0170] of Applicant's specification. Claims 1-41 are pending in the application. Reexamination and reconsideration of the application, as amended, are respectfully requested.

The present invention relates to a multi-layer piezoelectric element and an injection apparatus, for example, fuel injection apparatus of automobile engine, liquid injection apparatus of ink jet printer or the like, or a drive unit used in precision positioning device or vibration preventing device for an optical apparatus, and to a multi-layer piezoelectric element used as a sensor element mounted in combustion pressure sensor, knocking sensor, acceleration sensor, load sensor, ultrasound sensor, pressure sensor, yaw rate sensor or the like, or used as a circuit component mounted in piezoelectric gyro, piezoelectric switch, piezoelectric transducer, piezoelectric breaker or the like. (Applicant's specification, at p. 1, lines 7-19).

DRAWINGS:

The drawings stand objected to as failing to comply with 37 CFR 1.83(a). The Office states,

"The drawings must show every feature of the invention specified in the claims. Therefore, the glass layer formed between the piezoelectric layer and internal electrodes must be shown or the feature(s) canceled from the claim(s)."

In response, Applicant added new Figures 25A and 25B which show the glass layer formed between the piezoelectric layer and internal electrodes. Withdrawal of this objection is thus respectfully requested.

CLAIM REJECTIONS UNDER 35 U.S.C. § 112:

Claims 1-3 and 19-22 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Office states,

"The lack of description concerning the glass layer now claimed renders the claims indefinite. The specification never explicitly mentions the term 'glass layer'. Page 90 indicates that the intermediated layer 70 may be glass but that this has bad results, explicitly stating that this: 'acts as the start point of destruction'. Page 105 notes a 'glass-rich layer' but this is formed on the external electrode. Pages 112 and 113 as well as other pages note that the glass may be combined with an electrode material to form an electrode but that electrode is external. Other pages note the glass paste formed by silver, glass and a binder but it was not found in the specification that there exists a specific glass layer formed between the piezoelectric layer and internal electrodes. The Applicants provide antecedent basis for the existence of a glass layer(s) between a piezoelectric layer(s) and an internal electrode(s) in the specification at the places cited in the response to the first office action on the merits. The Examiner recommends adding a figure to show the glass layer placed between the piezoelectric layer or layers and the internal electrodes. Add language in the specification referring to the new figure and point out each feature of the figure. This will not be regarded as new matter."

In response, Applicant respectfully submits that the glass layer of claim 1 corresponds to the glass layer referred to at p. 38, lines 11-13 of Applicant's specification. Therefore, the glass layer of claim 1 does not correspond to the glass-rich layer formed on the external electrode which is referred to at p. 105 of Applicant's specification. However, in order to expedite the prosecution of the instant application, Applicant added new Figures, discussed above, clarifying what the glass layer is referring to. In addition, the specification was amended to

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describe the new Figures. Withdrawal of this rejection is thus respectfully requested.

CLAIM REJECTIONS UNDER 35 U.S.C. § 103:

Claims 1-3, 19, 20, 22, 25, 26, 28, 29, and 32-36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kawamoto (JP 2003-318458) in view of Ochi (JP 61-182284). Claims 21, 24, 27, 30, and 31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kawamoto (JP 2003-318458) in view of Ochi (JP 61-182284).

Applicant respectfully traverses the above rejections. Claim 1 is as follows:

A multi-layer piezoelectric element comprising:

a stack formed by stacking at least one piezoelectric layer and a plurality of internal electrodes consisting of first and second internal electrodes alternately one on another;

a first external electrode which is formed on a first side face of the stack and is connected to the first internal electrode;

a second external electrode which is formed on a second side face of the stack and is connected to the second internal electrode, and

a glass layer which is formed between said at least one piezoelectric layer and said a plurality of internal electrodes.

Applicant respectfully submits that the cited references cannot render claim 1 obvious, because the cited references fail to teach or suggest "a glass layer which is formed between said at least one piezoelectric layer and said a plurality of internal electrodes."

It is an aspect of the present invention that the glass layer formed between the internal electrode and the piezoelectric layer makes it possible to strengthen the

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bonding strength between the internal electrode and the piezoelectric layer. (Applicant's specification, at p. 37, line 22-p. 38, line 13).

The Office acknowledges that Kawamoto does not show glass. (Office Action, at p. 6, line 15). Instead, the Office cites Ochi stating that "Ochi shows (e.g. figs. 3, 6) use of glass (27, 28) in contact with his piezoelectric and electrode layers." (Office Action, at p. 6, lines 16-17).

In response, Applicant respectfully submits that the glass members 27, 28 of Ochi are formed on the surfaces of the stacked body. The glass members 27, 28 are not formed between the internal electrode and the piezoelectric layer.

In support of the above statements, Applicant submits the following partial translation of Ochi:

"Glass powder is deposited in strip shape on the portion where the internal electrode exposed and surrounding area thereof of the ceramic by electrophoresis method using suspension including glass powder. The deposited glass powder is fired to form a glass film. After that, electrical connection of the element is done." (Ochi, from the 20th line on the upper left section of page 3 to the 5th line on the upper right section of page 3)

In light of the foregoing, Applicant respectfully submits that the cited references cannot render claim 1 obvious, because the cited references fail to teach or suggest each and every claim limitation. Claims 2, 3, 19-22, and 24-36 depend from claim 1 and therefore, cannot be rendered obvious for at least the same reasons as claim 1. Withdrawal of these rejections is thus respectfully requested.

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los

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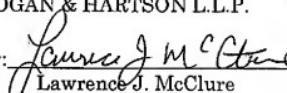
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Angeles, California telephone number (310) 785-4600 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,
HOGAN & HARTSON L.L.P.

Date: February 19, 2009

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